

CURRICULUM VITA

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and

Chaired Professor
Mathematics Department
Imperial College of Science, Technology and Medicine
Queens Gate, London, SW7 2AZ, UK

Formal Education:

Ph.D. Physics, University of Michigan, 1976
M.S. Physics/Mathematics, University of Michigan, 1971
B.S. Physics, University of Minnesota, 1967 (cum laude)

Research Interests:

Nonlinear science, especially nonlinear dynamics – ranging from integrable to chaotic behavior – in Hamiltonian systems for nonlinear optics and fluid dynamics. In nonlinear optics I am studying dynamics of laser-cavity optics and telecommunication pulses in fibers.¹ In fluid dynamics I am applying averaging, asymptotics and other methods from nonlinear dynamics to global ocean models, in order to describe and assess the effects of subgrid scales and turbulence. Recent work applies the Euler-Poincaré theory to develop turbulence closures for large eddy simulation. These are the so-called “alpha models” of turbulence.

Summary of Experience:

Thirty-two years experience with Los Alamos National Laboratory (LANL)

¹UNITED STATES PATENT # 6,157,762 patents the idea of using nonlinear amplifying loop mirrors (NALMs) to stabilize, shape and regenerate optical pulses in fibers at high bit rates. The idea treats the pulse propagation and re-amplification process as an iterated mapping. See I. Gabitov, D. D. Holm, B. Luce and A. Mattheus, *Optics Lett.* **20** (1995) 2490-2492.

performing R & D coordination in issues of national and international scientific interest in applied nonlinear dynamics research, theoretical physics and experimental design. 1984 National Award of Excellence for Significant Contribution to the Nuclear Weapons Program. Theoretical Design Team participant in 1991 Joint Verification Experiment for US/Soviet Threshold Testban Treaty. Founding Nonlinear Science Editor for Physics Letters A. Founding member and past Director of the LANL Center for Nonlinear Studies (CNLS), member and past co-leader of the Mathematical Modeling and Analysis Group (T-7) at LANL. Now Los Alamos National Laboratory Fellow and Chaired Professor in Mathematics, Imperial College of Science, Technology and Medicine (London, UK). Primary supervisor of twenty one post-doctoral fellows. Organizer of more than twenty scientific conferences and workshops.

Employment History:

2003–present: Chaired Professor in Mathematics, Imperial College of Science, Technology and Medicine (London, UK)

1988–present: Laboratory Fellow, Mathematical Modeling and Analysis Group, Los Alamos National Laboratory

1985–1988: Deputy Group Leader, Mathematical Modeling and Analysis Group, Los Alamos National Laboratory

1983–1985: Staff Member, Mathematical Modeling and Analysis Group, Los Alamos National Laboratory

1982–1983: Acting Director, Center for Nonlinear Studies, Los Alamos National Laboratory

1972–1983: Staff Member, Theoretical Design Group, Los Alamos National Laboratory

Fellowships and Honors:

January 2003, Royal Society Wolfson Fellow, Five Year Research Award at Imperial College of Science, Technology and Medicine (London, UK)

March 2001, Plenary Speaker, Fred Howes Memorial Workshop, held at MSRI, UC Berkeley

2000 Visiting Fellow, Isaac Newton Institute for Mathematical Sciences, Cambridge University, Cambridge, UK, October-December 2000

2000 Lecturer, MASIE Summer School, Course on “Hamiltonian Fluid Mechanics,” Peyresq, France, September 3 - 16

1998 Lecturer, DANISH CENTER FOR APPLIED MATHEMATICS AND MECHANICS, TECHNICAL UNIVERSITY OF DENMARK, Ph.D.-course / Advanced school, Variational Methods in Applied Mechanics, Lyngby, January 12 - 21

1997 Senior Assessment Panel, National Science Foundation, Division of Mathematical Sciences, International Assessment of the US Mathematical Sciences, January-July, 1997, <http://www.nsf.gov/pubs/1998/nsf9895/>

1997 UC Visiting Scholar, UCSC Mathematics Department, Santa Cruz, CA, January-May, 1997

1997 Los Alamos National Laboratory Achievement Award

1996 Scientific Advisory Board, Isaac Newton Institute for Mathematical Sciences, research programme in THE MATHEMATICS OF ATMOSPHERE AND OCEAN DYNAMICS, Cambridge University, Cambridge, UK

1996 Plenary Speaker, SIAM Annual Meeting, Kansas City, MO

1995 Participant, Isaac Newton Institute for Mathematical Sciences, research programme in LOW DIMENSIONAL BEHAVIOR OF PDEs, Cambridge University, Cambridge, UK

1991 Theoretical Design Team Participant, Joint Verification Experiment for US/Soviet Threshold Testban Treaty

1988–present, Laboratory Fellow, Los Alamos National Laboratory

1986–1994 Founding Editor, *Physics Letters A*, Nonlinear Science Section

1984 National Award of Excellence for Significant Contribution to the Nuclear Weapons Program

1984 Los Alamos National Laboratory, Distinguished Performance Award

1981–present, Executive Committee for Los Alamos Center for Nonlinear Studies

1967–1971 Danforth Fellow, University of Michigan

Major Conferences Organized:

Co-Organizer, CNLS Workshop, “Statistical Hydrodynamics,” held March 2002, at Santa Fe, NM.

Co-Organizer, NSF Workshop, “Mathematics in the Geosciences,” held March 2001, at IMA, U Minnesota.

Co-organizer, CNLS/ONR 1998 Conference, “Singularities in Nonlinear Physics, Mathematics and Engineering,” held January 4-6, 1998, in Santa Fe, NM.

1997 Co-chair, SIAM Workshop on Bioremediation and Porous/Fracture Flow, held Summer 1997 at Los Alamos, NM.

Co-chair, CNLS 1995 Conference on Nonlinear Phenomena in Ocean Dynamics

Co-chair, NEEDS '94 Conference on Nonlinear Evolution Equations and Dynamical Systems

Co-chair, CNLS 1993 Conference on Forces of Nature

Co-chair, CNLS 1988 Conference on Advances in Fluid Turbulence

Co-chair, University of California 1986 Summer School in Nonlinear Science

Co-chair, AMS-SIAM 1984 Summer Seminar on Systems of Nonlinear PDEs, held at College of Santa Fe

Chair, CNLS 1983 Conference on Fronts, Interfaces and Patterns

Co-chair, Joint Los Alamos/Limeil Conference on Hydrodynamics and Instabilities, June 28-July 2, 1982

Books Authored:

Crossover-Time in Quantum Boson and Spin Systems with G.P. Berman and E.N. Bulgakov, Lecture Notes in Physics, Vol. **m21**, Springer-Verlag ISBN 3-540-58011-5 (1994).

Hamiltonian Structure and Lyapunov Stability for Ideal Continuum Dynamics with J.E. Marsden and T.S. Ratiu, University of Montreal Press, ISBN 2-7606-0771-2 (1987).

Books and Journal Volumes Edited:

Advisor, *Series in Applied Mathematical Sciences*, Springer-Verlag, New York

Nonlinear Phenomena in Ocean Dynamics, with R. C. Malone, L. G. Margolin and R. Smith, *Physica D*, **98** (1996) 229 – 600.

Nonlinear Evolution Equations & Dynamical Systems, NEEDS '94, International Workshop Proceedings, with A. R. Bishop and V. G. Makhankov, World Scientific, Singapore (1995).

Proceedings of the Conference on Numerical Methods in High Temperature Physics, with R.E. Alcouffe and P.J. O'Rourke, LA-11342-C, Los Alamos National Laboratory (1988).

Advances in Fluid Turbulence, with G. Doolen, R. Ecke, and V. Steinberg, *Physica D*, **37** (1989) 1 – 564.

Nonlinear Systems of Partial Differential Equations in Applied Mathematics, with J.M. Hyman and B. Nicolaenko, Lectures in Applied Mathematics, Volume 23–Parts 1 and 2, AMS, Providence (1986).

Proceedings of the Joint Los Alamos/Limeil Conference on Hydrodynamics and Instabilities, June 28-July 2, 1982, Los Alamos National Laboratory LAUR (1983).

SCIENTIFIC JOURNAL EDITORSHIP:

Physics Letters A, Nonlinear Science section, March 1986 – February 1994
(Founding Editor)

UNITED STATES PATENT # 6,157,762: Nonlinear pulse reshaping for fiber transmission systems.

Granted December 5, 2000.

USP# 6,157,762 patents the idea of using nonlinear amplifying loop mirrors (NALMs) to stabilize, shape and regenerate optical pulses in fibers at high bit rates. The idea treats the pulse propagation and re-amplification process as an **iterated mapping**. See I. Gabitov, D. D. Holm, B. Luce and A. Mattheus, *Optics Lett.* **20** (1995) 2490-2492.

Our invention is the use of certain nonlinear optical devices (NALMs) to reshape and recover optical pulses which have suffered distortions during propagation in an optical fiber due to chromatic dispersion, energy losses, and other effects. Our device, which we name a Nonlinear Pulse Reshaping Device (NPRD), is specifically designed to minimize the differences between the amplitude and phase of input and output pulses. This causes the reshaping or recovery of optical pulses which have suffered distortion during propagation in an optical fiber that restores them into a form which is very similar in terms of amplitude and phase profiles to the pulses initially launched into the fiber.

To show that such a device can be built and is practical to operate, we wrote the scientific article entitled “Recovery of solitons with nonlinear amplifying loop mirrors,” published in 1995 by Ildar Gabitov, Darryl Holm, Benjamin Luce, and Arnold Mattheus. This article is a theoretical analysis of the use of Nonlinear Amplifying Loop Mirrors (NALM’s) to recover optical pulses.

Refereed Publications in the Last 20 Years:

In preparation.

“2D vector peakon collisions.”

With Z. Qiao.

In preparation for *Phys. Lett. A*.

“2D vector peakon filament dynamics.”

With S.T. Li and M. Nitsche.

In preparation for *Phys. Lett. A*.

“Collective coordinates for geodesic fluid motion: Measure-valued Solutions (Peakons, Filaments and Sheets, Strings and Branes) for the Euler-Poincaré Equations of Continuum Geodesic Motion in n dimensions.”

With M. F. Staley.

In preparation for *Phys. Lett. A*.

“Vector peakon dynamics for the 2D Camassa-Holm equation.”

With M. F. Staley.

In preparation for *SIADS*.

“Wave Structures and Nonlinear Balances in a Family of 2+1 Evolutionary PDEs.”

With M. F. Staley.

In preparation for *SIADS*.

“On the Camassa-Holm hierarchy, N -dimensional integrable systems, and algebro-geometric solutions.”

With Z. Qiao.

In preparation for *Physica D*.

“ R -matrix for a geodesic flow associated with a new integrable peakon equation”

With Z. Qiao.

In preparation for *Phys. Lett. A*.

“Baroclinic Instability of the α -model.”

With B. A. Wingate.

In preparation for *J. Phys. Ocean.*

“Craik-Criminale solutions and elliptic instability in the Navier-Stokes-alpha model.”

With B. Fabijonas.

In preparation for *Phys. Rev Lett.*

“Kelvin waves on a straight vortex filament governed by the Euler-alpha equations: Dispersion relation and energy functional.”

With Yasuhide Fukumoto.

In preparation for *Phys. Rev Lett.*

“Circle vortex filament dynamics governed by the Euler-alpha equations: self-induced velocity and energy.”

With Vakhtang Putkaradze.

In preparation for *Phys. Rev Lett.*

“Nonlocally regularized shock waves without viscosity.”

With R. B. Lowrie and M. F. Staley.

In preparation for *Phys. Fluids*

Submitted.

“Traveling wave solutions for a class of $1 + 1$ nonlinear shallow water wave models.”

With Chongsheng Cao and E. S. Titi,

Submitted Jan 2003 to *J. Dyn. and Diff. Eqns.*

“Commutator-errors in large-eddy simulation.”

With B. J. Geurts.

Submitted to *Phys. Fluids*

“Euler-Poincaré formulation and elliptic instability for ideal gradient fluids.”

With B. Fabijonas,

Submitted to *Int. J. Engineering Sci.*

“The effect of turbulence models on elliptic instability.”

With B. Fabijonas,

Submitted to *Phys. Fluids*.

“Multi-frequency Craik-Criminale solutions of the Navier-Stokes equations.”

With B. Fabijonas,

Submitted to *J. Fluid Mech.*

“Camassa-Holm, Korteweg-de Vries-5 and other asymptotically equivalent equations for shallow water waves.”

With H. Dullin and G. A. Gottwald.

Submitted to *J. Fluid Mech.*

To appear.

“Navier Stokes- α Equations: Solutions and Turbulent Fluid Flow.”

With V. Poutkaradze, P. D. Weidman and B. A. Wingate.

To appear in *J. Stat. Phys.*.

“Modeling Mesoscale Turbulence in the Barotropic Double Gyre Circulation.”

With Balu Nadiga.

Submitted May 17, 2002. To appear in *J. Phys. Ocean.*

“Wave Structures and Nonlinear Balances in a Family of Evolutionary PDEs.”

With M. F. Staley.

To appear in *SIADS*.

Published 2003.

“Camassa-Holm, Korteweg-de Vries-5 and other asymptotically equivalent equations for shallow water waves.”

With H. Dullin and G. A. Gottwald.

Fluid Dyn. Res. **33** (2003) 7395

“Intermittency in the joint cascade of energy and helicity.”

With Q. Chen, S. Chen and G. I. Eyink.

Phys. Rev Lett. **90**, 214503-1-4 (2003)

“Mean effects of turbulence on elliptic instability in fluids.”

With B. R. Fabijonas,

Phys. Rev. Lett. **90** (12) (2003) 1245001-1-4.

“Regularization modeling for large-eddy simulation.”

With B. J. Geurts.

Phys. Fluids **15**, L13-L16 (2003).

“Nonlinear balance and exchange of stability in dynamics of solitons, peakons, ramps/cliffs and leftons in a 1+1 nonlinear evolutionary pde.”

With M. F. Staley.

Phys. Lett. A **308**, 437-444 (2003).

“Rasetti-Regge Dirac Bracket Formulation of Lagrangian Dynamics of Vortex Filaments,” Proceedings of IMACS Conference, Athens, GA, April 9-12,

2001. *Mathematics and Computers in Simulation* **62**, 53-63 (2003).
<http://xxx.lanl.gov/abs/nlin.CD/0103041>

Published 2002.

“A new integrable equation with peakon solutions.”

With A. Degasperis and A. N. W. Hone,
Theoret. and Math. Phys. **133**, 1463-1474 (2002).

“Euler-Poincaré dynamics of perfect complex fluids.”

In *Geometry, Mechanics, and Dynamics: in honor of the 60th birthday of Jerrold E. Marsden* edited by P. Newton, P. Holmes and A. Weinstein. Springer, pp. 113-167 (2002). <http://xxx.lanl.gov/abs/nlin.CD/0103041>.

“Kármán–Howarth Theorem for the Lagrangian averaged Navier-Stokes alpha (LANS- α) model.”

J. Fluid Mech., **467** (2002) 205-214.

“Averaged Lagrangians and the mean dynamical effects of fluctuations in continuum mechanics,”

Physica D **170** (2002) 253–286.

“Transient vortex events in the initial value problem for turbulence.”

With R. M. Kerr.
Phys. Rev. Lett. **88** (24) (2002) 244501-1-4.

“Lagrangian averages, averaged Lagrangians, and the mean effects of fluctuations in fluid dynamics.”

Chaos **12** 518-530 (2002).

“Alpha-modeling strategy for LES of turbulent mixing.”

With B. J. Geurts, in *Turbulent Flow Computation*, edited by D. Drikakis and B. G. Geurts, Kluwer: London, pp. 237-278 (2002).

“Leray simulation of turbulent shear layers.”

With B. J. Geurts.

In *Advances in Turbulence IX: Proceedings of the Ninth European Turbulence conference*. (Ed. J. P. Castro and P. E. Hancock) CIMNE:Barcelona, pp 337-340 (2002). ArXiv:nlin.CD/0202062.

“Toward an extended-geostrophic Euler–Poincaré model for mesoscale oceano-

graphic flow.”

With J. S. Allen and P. A. Newberger.

In *Large-Scale Atmosphere-Ocean Dynamics 1: Analytical Methods and Numerical Models*. Edited by J. Norbury & I. Roulstone, Cambridge University Press: Cambridge, pp. 101–125.

“The Euler–Poincaré equations in geophysical fluid dynamics,”

With J. E. Marsden and T. S. Ratiu.

In *Large-Scale Atmosphere-Ocean Dynamics 2: Geometric Methods and Models*. Edited by J. Norbury & I. Roulstone, Cambridge University Press: Cambridge (2002) pp. 251–299.

“Stepwise Precession of the resonant swinging spring.”

With Peter Lynch.

SIAM J. Applied Dyn. Syst. **1** (1) 44–64 (2002).

<http://xxx.lanl.gov/abs/nlin.CD/0104038>.

<http://epubs.siam.org/sam-bin/dbq/article/38857>

“Variational principles for Lagrangian averaged fluid dynamics,”

J. Phys. A: Math. Gen. **35** (2002) 1–10.

<http://xxx.lanl.gov/abs/nlin.CD/0103043>.

“The three dimensional viscous Camassa-Holm equations, and their relation to the Navier-Stokes equations and turbulence theory.”

With C. Foias and E. S. Titi.

J. Dyn. and Diff. Eqns. **14** (2002) 1–35.

<http://xxx.lanl.gov/abs/nlin.CD/0103039>.

Published 2001.

“Variational principles, geometry and topology of Lagrangian-averaged fluid dynamics.”

In *An Introduction to the Geometry and Topology of Fluid Flows*, R. L. Ricca, Ed. Kluwer Academic Publishers, The Netherlands (2001) pp. 271–291.

“An integrable shallow water equation with linear and nonlinear dispersion.”

With Holger R. Dullin and Georg Gottwald.

Phys. Rev. Lett., **87**, no.19, (2001) 194501–04.

<http://xxx.lanl.gov/abs/nlin.CD/0104004>.

“The Complex Geometry of Piecewise Solutions of Integrable Nonlinear PDE’s of Shallow Water and Dym Type.”

With M. S. Alber, R. Camassa, Y. N. Fedorov and J. E. Marsden.

Commun. Math. Phys. **221** (2001) 197-227.

“Introduction to HVBK dynamics.”

In *Quantized Vortex Dynamics and Superfluid Turbulence*. Edited by C.F. Barenghi, R.J. Donnelly and W.F. Vinen, Lecture Notes in Physics, volume 571, Springer-Verlag, 2001, pp. 114-130.

<http://xxx.lanl.gov/abs/nlin.CD/0103040>.

“The Navier-Stokes-alpha model of fluid turbulence.”

With C. Foias and E. S. Titi.

Physica D **152** (2001) 505-519.

<http://xxx.lanl.gov/abs/nlin.CD/0103037>.

“Navier-Stokes-alpha model: LES equations with nonlinear dispersion.”

With J. A. Domaradzki.

In *Modern Simulation Strategies for Turbulent Flow*, B. J. Geurts, Editor. (R.T. Edwards, Inc.: Flourtown, PA, USA 2001) pp 107-122.

<http://xxx.lanl.gov/abs/nlin.CD/0103036>.

“Navier-Stokes-alpha model: LES equations with nonlinear dispersion.”

With J. A. Domaradzki.

Special LES volume of *ERCOFTAC Bulletin*, **48** March (2001) 22-25.

“Integrable vs nonintegrable geodesic soliton behavior,”

With O. Fringer,

Physica D **150** (2001) 237-263.

<http://xxx.lanl.gov/abs/solv-int/9903007>.

Published 2000.

“An optimal control formulation for inviscid incompressible ideal fluid flow.”

With A. M. Bloch, P. E. Crouch and J. E. Marsden.

Proc. of the 39th IEEE Conference on Decision and Control, Sydney, Australia, December 2000. *Proc. CDC* **39** (2000) 1273-1279.

<http://xxx.lanl.gov/abs/nlin.CD/0103042>.

Published 1999.

“Alpha models for 3D Eulerian mean fluid circulation,” *Nuovo Cimento C* **22** (1999) 857-866.

“On Billiard Solutions of Nonlinear PDE’s,” with M. S. Alber, R. Camassa, Y. N. Fedorov and J. E. Marsden, *Phys. Lett. A* **264** (1999) 171-178.

“The Camassa-Holm equations and turbulence in pipes and channels,” with S. Y. Chen, C. Foias, E.J. Olson, E.S. Titi and S. Wynne, *Physica D*, **133** (1999) 49-65.

“Direct numerical simulations of the Navier-Stokes alpha model,” with S. Y. Chen, L. G. Margolin and R. Zhang, *Physica D*, **133** (1999) 66-83.(LA-UR-99-185), <http://xxx.lanl.gov/abs/chao-dyn/9902015>.

“Fluctuation effects on 3D Lagrangian mean and Eulerian mean fluid motion,” *Physica D*, **133** (1999) 215-269.(LAUR # 99-182) <http://xxx.lanl.gov/abs/chao-dyn/9903034>.

H. Cendra, D.D. Holm, J. E. Marsden and T. S. Ratiu [1998], Lagrangian Reduction, the Euler–Poincaré Equations, and Semidirect Products. *Arnol’d Festschrift Volume II*, **186** Am. Math. Soc. Translations Series 2, (1999) 1-25, <http://xxx.lanl.gov/abs/chao-dyn/9906004>.

D.D. Holm, S. Kouranbaeva, J.E. Marsden, T. Ratiu and S. Shkoller [1998], A nonlinear analysis of the averaged Euler equations. *Arnol’d Festschrift Volume II*, **186** Am. Math. Soc. Translations Series 2, <http://xxx.lanl.gov/abs/chao-dyn/9903036>.

“A connection between the Camassa-Holm equations and turbulence in pipes and channels,” with S. Chen, C. Foias, E.J. Olson, E.S. Titi and S. Wynne, *Phys. Fluids*, **11** (1999) 2343-2353, <http://xxx.lanl.gov/abs/chao-dyn/9903033>.

“Variational methods and nonlinear quasigeostrophic waves,” with Jinqiao Duan and Kaitai Li *Phys. Fluids*, **11** (1999) 875-879.

Published 1998.

“The Camassa-Holm equations as a closure model for turbulent channel and pipe flows,” with S. Chen, C. Foias, E.J. Olson, E.S. Titi and S. Wynne, *Phys. Rev. Lett.*, **81** (1998) 5338-5341, <http://xxx.lanl.gov/abs/chao-dyn/9804026>.

“The Euler–Poincaré equations and semidirect products with applications to continuum theories,” with J. E. Marsden and T. S. Ratiu, *Adv. in Math.*, **137** (1998) 1-81, <http://xxx.lanl.gov/abs/chao-dyn/9801015>.

“Euler–Poincaré models of ideal fluids with nonlinear dispersion,” with J. E. Marsden and T. S. Ratiu, *Phys. Rev. Lett.*, **80** (1998) 4173-4177.

“Hamilton’s principle for quasigeostrophic motion,” with Vladimir Zeitlin, LANL Report LA-UR-97-2205, *Phys. Fluids*, **10** (1998) 800-806, <http://xxx.lanl.gov/abs/chao-dyn/9801018>.

“The Maxwell-Vlasov equations in Euler-Poincaré form,” with H. Cendra, M. J. W. Hoyle and J. E. Marsden, *J. Math. Phys.*, **39** (1998) 3138-3157, <http://xxx.lanl.gov/abs/chao-dyn/9801016>.

Published 1997.

“Long-time shallow-water equations with a varying bottom,” with R. Camassa and C.D. Levermore, *J. Fluid Mech.*, **349** (1997) 173-189.

“Low-noise picosecond soliton transmission using concatenated nonlinear amplifying loop mirrors,” with I. Gabitov, B. P. Luce and A. Mattheus, *J. Opt. Soc. Am. B*, **14** (1997) 1850-1855. LAUR-96-1352

“A Note on Kelvin Waves in Balance Models,” with J. S. Allen and P. R. Gent, *J. Phys. Ocean.* **27** (1997) 2060-2063. LAUR-96-4475.

“Homoclinic Orbits and Chaos in a Second-Harmonic Generating Optical Cavity,” with A. Aceves, G. Kovačič and I. Timofeyev *Phys. Lett. A* **233** (1997) 203-208.

“Secondary instabilities of flows with elliptic streamlines,” with B. Fabijonas and A. Lifschitz, *Phys. Rev. Lett.* **78** (1997) 1900-1903.

Published 1996.

“Extended-geostrophic Hamiltonian models for rotating shallow water motion,” with J. S. Allen, *Physica D*, **98** (1996) 229-248.

“Long-Time Effects of Bottom Topography in Shallow Water,” with R. Camassa and C.D. Levermore, *Physica D*, **98** (1996) 258-286.

“Self-consistent wave-mean flow interaction dynamics and its Hamiltonian formulation for a rotating stratified incompressible fluid,” with I. Gjaja. *Physica D*, **98** (1996) 343-378.

“Hamiltonian Balance Equations,” *Physica D*, **98** (1996) 379-414.

“The Ideal Craik-Leibovich Equations,” *Physica D*, **98** (1996) 415-441.

“Three-dimensional Stability of Elliptical Vortex Columns in External Strain Flows,” with B.J. Bayly and A. Lifschitz, *Trans. Roy. Soc. London*, **354** (1996) 895-926.

“Homoclinic orbits in the Maxwell-Bloch equations with a probe,” with G. Kovacic and T.A. Wettergren, *Phys. Rev. E*, **54** (1996) 243-256.

Published 1995.

“Recovery of solitons with nonlinear amplifying loop mirrors,” with I. Gabitov, B. Luce and A. Mattheus, *Optics Lett.* **20** (1995) 2490-2492.

“Near Integrability and Chaos in a Resonant-Cavity Laser Model,” with G. Kovacic and T.A. Wettergren, *Phys. Lett. A*, **200** (1995) 299-307.

“Crossover behavior in quantum nonlinear resonance in a hydrogen atom,” with G.P. Berman and E.N. Bulgakov, *Physica D*, **83** (1995) 55-58.

“Nonlinear Resonance and Dynamical Chaos in a Diatomic Molecule Driven by a Resonant IR Field,” with G.P. Berman and E.N. Bulgakov, *Phys. Rev. A*, **52** (1995) 3074-3081.

“On the Link between Umbilic Geodesics and Soliton Solutions of Nonlinear PDE’s,” with M. Alber, R. Camassa, and J. E. Marsden, *Proc. Roy. Soc.* **450** (1995) 677-692.

Published 1994.

“Dynamical Chaos in $SU(2) \times U(1)$ theory,” with G. Berman, E. Bulgakov, and Y. Kluger, *Phys. Lett. A* **194** (1994) 251-264.

“Quantum Computer on a Class of One-Dimensional Ising Systems,” with

G. Berman, G. D. Doolen, and V.I. Tsifrinovich, *Phys. Lett. A* **193** (1994) 444–450.

“The Geometry of Peaked Solitons and Billiard Solutions of a Class of Integrable PDE’s,” with M.S. Alber, R. Camassa and J.E. Marsden, *Lett. Math. Phys.* **32** (1994) 137–151.

“A New Integrable Shallow Water Equation”, with R. Camassa and J.M. Hyman, *Adv. Appl. Mech.*, Academic Press: Boston, 1994, vol **31**, pp 1–33.

“Quantum Chaos of Atoms in a Resonator Driven by an External Resonant Field,” with G.P. Berman and E.N. Bulgakov, *Phys. Rev. A* **49** (1994) 4943–4956.

Published 1993.

“An Integrable Shallow Water Equation with Peaked Solitons”, with R. Camassa, *Phys. Rev. Lett.* **71** (1993) 1661–1664, <http://xxx.lanl.gov/abs/patt-sol/9305002>.

“Violation of the Semi-Classical Approximation and Quantum Chaos in a Paramagnetic Spin System,” with G.P. Berman, E.N. Bulgakov, and V.I. Tsifrinovich, *Phys. Lett. A* **181** (1993) 296–307.

Published 1992.

“Dispersive Barotropic Equations for Stratified Mesoscale Ocean Dynamics,” with R. Camassa, *Physica D* **60** (1992) 1–15.

“Homoclinic Chaos in a Laser-Matter System,” with G. Kovacic, *Physica D* **56** (1992) 270–300.

“Chaotic Dynamics Due to Competition Among Degenerate Modes in a Ring-Cavity Laser,” with A. Aceves and G. Kovacic, *Phys. Lett A* **161** (1992) 499–505.

“Multiple Lie-Poisson Structures, Reductions, and Geometric Phases for the Maxwell-Bloch Traveling-Wave Equations,” with D. David, *J. Nonlin. Sci.* **2** (1992) 241–262.

Published 1991.

“A Tri-Hamiltonian Formulation of the Self-Induced Transparency Equations,” with Allan P. Fordy, *Phys. Lett A* **160** (1991) 143–148.

“Zero-helicity Lagrangian Kinematics in Three-Dimensional Advection,” with Y. Kimura, *Phys. Fluids A* **3** (1991) 1033–1038.

“Homoclinic Chaos for Ray Optics in a Fiber,” with G. Kovacic, *Physica D* **51**, (1991) 177–188.

“Lie-Poisson Description of Hamiltonian Ray Optics,” with K.B. Wolf, *Physica D* **51**, (1991) 189–199.

“Chaotic Laser-Matter Interaction,” with G. Kovacic and B. Sundaram, *Phys. Lett A* **154** (1991) 346–352.

“Elliptical Vortices and Integrable Hamiltonian Dynamics of the Rotating Shallow Water Equations,” *J. Fluid Mech.* **227** (1991) 393–406.

Published 1990.

“Moment Invariants for the Vlasov Plasma,” with W.P. Lysenko and J.C. Scovel, *J. Math. Phys.* **31** (1990) 1610–1615.

“Hamiltonian Chaos in Nonlinear Optical Polarization Dynamics,” with D. David and M.V. Tratnik, *Physics Reports* **187** (1990) 281–367.

Published 1989.

“Horseshoe Chaos in a Periodically Perturbed Polarized Optical Beam,” with D. David and M.V. Tratnik, *Phys. Lett. A* **138** (1989) 29–36.

“Integrable and Chaotic Polarization Dynamics in Nonlinear Optical Beams,” with D. David and M.V. Tratnik, *Phys. Lett. A* **137** (1989) 355–364.

“Finite Dimensionality in the Complex Ginzburg-Landau Equation,” with C.R. Doering, J.D. Gibbon, and B. Nicolaenko, *Contemporary Mathematics* **99** (1989) 117–141.

“Lyapunov Stability of Ideal Stratified Fluid Equilibria in Hydrostatic Balance,” with B. Long, *Nonlinearity* **2** (1989) 23–35.

Published 1988.

“Finite Dimensionality in the Laser Equations in the Good Cavity Limit,” with C.R. Doering, J.N. Elgin, and J.D. Gibbon, *Phys. Lett. A* **129** (1988) 310–316.

“Hamiltonian Structure for Two-Dimensional Hydrodynamics with Nonlinear Dispersion,” *Phys. Fluids* **31** (1988) 2371–2373.

“Hamiltonian Formulation of Ferromagnetic Hydrodynamics,” with B. Kupershmidt, *Phys. Lett. A* **129** (1988) 93–100.

“Low Dimensional Behavior in the Complex Ginzburg Landau Equation,” with C.R. Doering, J.D. Gibbon, and B. Nicolaenko, *Nonlinearity* **1** (1988) 179–209.

“1-D Closure Models for 3-D Incompressible Viscoelastic Free Jets: von Karman Flow Geometry and Elliptical Cross Section,” with S. Bechtel, K. Lin, and M.G. Forest, *J. Fluid Mech* **196** (1988) 241–262.

“Lyapunov Stability Analysis of Magnetohydrodynamic Plasma Equilibria with Axisymmetric Toroidal Flow,” with J.A. Almaguer, E. Hameiri, and J. Herrera, *Phys. Fluids* **31** (1988) 1930–1939.

“The Analogy Between Spin Glasses and Yang-Mills Fluids,” with B. Kupershmidt, *J. Math Phys.* **29** (1988) 21–30.

Published 1987.

“Exact Lyapunov Dimension of the Universal Attractor for the Complex Ginzburg-Landau Equation,” with C.R. Doering, J.D. Gibbon, and B. Nicolaenko, *Phys. Rev. Lett.* **59** (1987) 2911–2914.

“Nonlinear Stability of Inviscid Flows in Three Dimensions: Incompressible Fluids and Barotropic Fluids,” with H.D.I. Abarbanel, *Phys. Fluids* **30** (1987), 3369–3382.

“Superfluid Plasmas: Multivelocitly Nonlinear Hydrodynamics of Superfluid Solutions with Charged Condensates Coupled Electromagnetically,” with B. Kupershmidt, *Phys. Rev. A* **36** (1987) 3947–3956.

“Hall Magnetohydrodynamics: Conservation Laws and Lyapunov Stability,” *Phys. Fluids* **30** (1987) 1310–1322.

“Hamiltonian Dynamics and Stability Analysis of Neutral Electromagnetic Fluids with Induction,” *Physica D* **25** (1987) 261–287.

Published 1986.

“Hamiltonian Theory of Relativistic MHD with Anisotropic Pressure,” with B. Kupershmidt, *Phys. Fluids* **29** (1986) 3889–3891.

“Hamiltonian Dynamics of a Charged Fluid, Including Electro- and Magnetohydrodynamics,” *Phys. Lett. A* **114** (1986) 137–141.

“Oscillation Center Theory and Pondermotive Stabilization of the Low-Frequency Plasma Modes,” with A.N. Kaufman and P.L. Similon, *Phys. Fluids* **29** (1986) 1908–1922.

“Hamiltonian Formulation of the Baroclinic Quasigeostrophic Fluid Equations,” *Phys. Fluids* **29** (1986) 7–8.

“Hamiltonian Structure and Lyapunov Stability of a Hyperbolic System of Two-Phase Flow Equations Including Surface Tension,” with B. Kupershmidt, *Phys. Fluids* **29** (1986) 986–991.

“Nonlinear Stability Analysis of Stratified Ideal Fluid Equilibria,” with H.D.I. Abarbanel, J.E. Marsden, and T. Ratiu, *Phil Trans. Roy. Soc. (London) A* **318** (1986) 349–409.

“Gyroscopic Analog for Collective Motion of a Stratified Fluid,” *J. of Math. Anal. and Appl.* **117** (1986) 57–80.

“Lyapunov Stability Conditions for Relativistic Multifluid Plasma,” with B. Kupershmidt, *Physica D* **18** (1986) 405–409.

“Lyapunov Stability of Relativistic Fluids and Plasmas,” with B. Kupershmidt, *Phys. Fluids* **29** (1986) 49–68.

“Hydrodynamics and Electrodynamics of Adiabatic Multiphase Fluids and Plasmas,” with B. Kupershmidt, *Int. J. Multiphase Flow* **12** (1986)

667–680.

“A Multipressure Regularization for Multiphase Flow,” with B. Kupershmidt, *Int. J. Multiphase Flow* **12** (1986) 681–697.

Published 1985.

“Nonlinear Stability of Fluid and Plasma Equilibria,” with J.E. Marsden, T. Ratiu and A. Weinstein, *Physics Reports* **123** (1985) 1–116.

“Hamiltonian Structure for Alfvén Wave Turbulence Equations,” *Phys. Letter A* **108** (1985) 445–447.

“Electromagnetic Solitary Waves in Magnetized Plasmas,” with R.D. Hazeltine and P.J. Morrison, *J. Plasma Phys.* **34** (1985) 103–114.

“Hamiltonian Formalism for General Relativistic Adiabatic Fluids,” *Physica D* **23** (1985) 1–36.

“Hamiltonian Differencing of Fluid Dynamics,” with B. Kupershmidt and C.D. Levermore, *Adv. Appl. Math.* **6** (1985) 52–84.

“Relativistic Magnetohydrodynamics as a Hamiltonian System,” with B. Kupershmidt, *Comptes Rendus, Serie 1*, **300** (1985) 153–156.

“Structure of Shock Implosion in Plasma,” with S. Johnson and K. Lonngren, *Lett. Nuovo Cim.* **42** (1985) 241–245.

Published 1984.

“Multipressure Regularization for Multiphase Flow,” with B. Kupershmidt, *Phys. Lett. A* **106** (1984) 165–168.

“Ponderomotive Hamiltonian and Lyapunov Stability for Magnetically Confined Plasma in the Presence of R.F. Field,” with Phillipe Simion and A.N. Kaufman, *Phys. Lett. A* **106** (1984) 29–33.

“The Lie-Transformed Vlasov Action Principle: Relativistically Covariant Wave Propagation and Self-Consistent Ponderomotive Effects,” with A.N. Kaufman, *Phys. Lett. A* **105** (1984) 277–279.

“Richardson Number Criterion for the Nonlinear Stability of Three-Dimensional Stratified Flow,” with H.D.I. Arbarbanel, J.E. Marsden, and T. Ratiu, *Phys. Rev. Lett.* **52** (1984) 2352–2355.

“Relativistic Chromohydrodynamics and Yang-Mills-Vlasov Plasma,” with B. Kupershmidt, *Phys. Lett. A* **105** (1984) 225–228.

“Relativistic Fluid Dynamics as a Hamiltonian System,” with B. Kupershmidt, *Phys. Lett. A* **101** (1984) 23–26.

“Planar Incompressible Yang-Mills Magnetohydrodynamics,” with B. Kupershmidt, *Lett. Nuovo Cim.* **40** (1984) 70–82.

“Yang-Mills Magnetohydrodynamics: Nonrelativistic Theory,” with B. Kupershmidt, *Phys. Rev. D* **30** (1984) 2557–2560.

Published 1983.

“Canonical Maps Between Poisson Brackets in Eulerian and Lagrangian Descriptions of Continuum Mechanics,” with B. Kupershmidt and C.D. Levermore, *Phys. Lett. A* **98** (1983) 389–395.

“Nonlinear Stability Conditions and A Priori Estimates for Barotropic Hydrodynamics,” with J.E. Marsden, T. Ratiu, and A. Weinstein, *Phys. Lett. A* **98** (1983) 15–21.

“Self-Similar Detonation Waves,” with J.D. Logan, *J. Physics A* **16** (1983) 2035–2047.

“Magnetic Tornadoes: Three-Dimensional Affine Motions in Ideal Magnetohydrodynamics,” *Physica D* **8** (1983) 170–182.

“Noncanonical Hamiltonian Formulation of Ideal Magnetohydrodynamics,” with B. Kupershmidt, *Physica D* **7** (1983) 330–333.

“Poisson Brackets and Clebsch Representations for Magnetohydrodynamics, Multifluid Plasmas, and Elasticity,” with B. Kupershmidt, *Physica D* **6** (1983) 347–363.

“The Hamiltonian Structure of Classical Chromohydrodynamics,” with J. Gibbons and B. Kupershmidt, *Physica D* **6** (1983) 179–194.

“Poisson Structures of Superconductors,” with B. Kupershmidt, *Phys. Lett. A* **93** (1983) 177–181.

Published 1982.

“Gauge-Invariant Poisson Brackets for Chromohydrodynamics,” with J. Gibbons and B. Kupershmidt, *Phys. Lett. A* **90** (1982) 281–283.

“Poisson Structures of Superfluids,” with B. Kupershmidt, *Phys. Lett. A* **91** (1982) 425–430.

Published 1981.

“Converging Finite-Strength Shocks,” with R.A. Axford, *Physica D* **2** (1981) 194–202.

“Expansion of a Cold Ion Cloud,” with S. Johnson and K. Lonngren, *Appl. Phys. Lett.* **38** (1981) 519–521.

Unrefereed Publications in the Last 20 Years:

“Infomercial for Applied Mathematics,” in *Current and Future Directions in Applied Mathematics*, Edited by Mark Alber, Bei Hu, and Joachim Rosenthal. ISBN: 0-8176-3956-X. Birkhauser, 1997 pp 15–20.
<http://www.birkhauser.com/cgi-win/ISBN/0-8176-3956-X>

“Nonlinear Amplification of Solitons in High Dispersion Fiber Transmission Systems,” with I. Gabitov, B. Luce, and A. Mattheus, in *NEEDS '94 Proceedings*, V. G. Makhankov, A. R. Bishop and D. D. Holm, ed., World Scientific: New Jersey, 1995, pp. 259–265.

“The Geometry of Weak Solutions of Certain Integrable Nonlinear PDE’s,” with M. Alber, R. Camassa, and J. E. Marsden, in *NEEDS '94 Proceedings*, V. G. Makhankov, A. R. Bishop and D. D. Holm, ed., World Scientific: New Jersey, 1995, pp 3–8.

“Chaotic dynamics in the Maxwell-Bloch equations,” in *Chaos in Australia*, G. Brown and A. Opie, ed., World Scientific: New Jersey, 1993, pp. 57–82.

“Chaotic Dynamics Due to Competition among Degenerate Modes in a Ring-Cavity Laser,” with A. Aceves and G. Kovacic, in *Nonlinear Processes in Physics*, A. S. Fokas, D. J. Kaup, A. C. Newell, and V. E. Zakharov, ed., Springer-Verlag: Berlin, 1993, pp. 218–227.

“The Rotor and the Pendulum,” with J.E. Marsden, in *Symplectic Geometry and Mathematical Physics*, P. Donato, C. Duval, J. Elhadad, G. M. Tuynman, ed., Prog. in Math. Vol. **99**, Birkhauser: Boston, 1991, pp. 189–203.

“Order and Chaos in Polarized Nonlinear Optics,” in *Chaos and Order*, N. Joshi and R. L. Dewar, ed., World Scientific: Singapore, 1991, pp. 56–70.

“Integrable Hamiltonian Dynamics of Elliptical-Vortex Solutions for the Rotating Shallow Water Equations,” in Enrico Fermi School of Physics, *Nonlinear Topics in Ocean Physics*, A. Osborne, ed., North-Holland: Amsterdam, 1991, pp. 175–184.

“Nonlinear Stability of Ideal Fluid Equilibria,” in Enrico Fermi School of Physics, *Nonlinear Topics in Ocean Physics*, A. Osborne, ed., North-Holland: Amsterdam, 1991, pp. 133–173.

“Lagrangian Particle Kinematics in Three-Dimensional Convection,” with Y. Kimura and J. C. Scovel, *Nonlinear Structures in Physical Systems: Pattern Formation, Chaos, and Waves*, L. Lam and H. C. Morris, ed., Springer-Verlag: Berlin, 1990, pp. 184–191.

“Hamiltonian Chaos in a Nonlinear Polarized Optical Beam,” with D. David and M. V. Tratnik, in *1989 Lectures in Complex Systems*, Addison-Wesley: Redwood City, CA, 1990, pp. 191–211.

“Chaotic Behavior in Nonlinear Polarization Dynamics,” with D. David and M. V. Tratnik, in *Solitons in Physics, Mathematics, and Nonlinear Optics*, P. J. Olver and D. H. Sattinger, ed., IMA Vol. **25**, Springer-Verlag: Berlin, 1990, pp. 45–63.

“Finite Dimensionality in the Complex Ginzburg-Landau Equation,” with C. R. Doering and J. D. Gibbon, in *Nonlinear evolution equations: integrability and spectral methods*, A. Degasperis, A. P. Fordy and M. Lakshmanan, ed., Manchester University Press, 1990, pp. 463–476.

“Hamiltonian Chaos in a Nonlinear Polarized Optical Beam,” with D. David

and M. V. Tratnik, in *1989 Lectures in Complex Systems*, Addison-Wesley: Redwood City, CA, 1990, pp. 191-211.

“Chaotic Behavior in Nonlinear Polarization Dynamics,” with D. David and M. V. Tratnik, in *Solitons in Physics, Mathematics, and Nonlinear Optics*, P. J. Olver and D. H. Sattinger, ed., IMA Vol. **25**, Springer-Verlag: Berlin (1990), 45-63.

“Moment Methods in Optics,” with W. P. Lysenko and J. C. Scovel, in *Proceedings of the Monterey Accelerator Design Conference, July, 1989*.

“Hamiltonian Reduction and Complex Behavior in Nonlinear Polarization Dynamics,” with D. David and M. V. Tratnik, in *Proceedings of the Conference on Group Theoretical Methods and Integrable Systems, July, 1988*, University of Montreal, 1989.

“1-D Closure Models for Slender 3-D Viscoelastic Free Jets: von Karman Flow Geometry and Elliptical Cross Section,” with S. E. Bechtel, M. G. Forrest, and K. J. Lin, in *Proceedings, First National Meeting on Mechanics, July 1988, Cincinnati, OH*, 1989, pp. 1-13.

“Hamiltonian Structure and Stability Analysis,” in *Symmetries and Nonlinear Phenomena*, D. Levi and P. Winternitz, ed., Springer-Verlag: Berlin, 1989, pp. 51-98.

“Hamiltonian Techniques for Relativistic Fluid Dynamics and Stability Theory,” in *Relativistic Fluid Dynamics*, M. Anile and Y. Choquet-Bruhat, ed., Lecture Notes in Mathematics, Vol. **1385**, Springer-Verlag: Berlin, 1989, pp 65-151.

“Hamiltonian structure and stability analysis,” in *Symmetries and Nonlinear Phenomena* (Paipa, 1988), CIF Ser., 9, World Sci. Publishing, Teaneck, NJ, 1988, pp 51-98.

“The Hamiltonian Structure of Continuum Mechanics in Material, Inverse Material, Spatial and Convective Representations,” in *Hamiltonian Structure and Lyapunov Stability for Ideal Continuum Dynamics*, by D. D. Holm, J. E. Marsden, and T. S. Ratiu, Univ. Montreal Press, 1986, pp. 1-124.

“Lyapunov Stability of Ideal Compressible and Incompressible Fluid Equilibria in Three Dimensions,” in *Hamiltonian Structure and Lyapunov Stability*

for *Ideal Continuum Dynamics*, by D. D. Holm, J. E. Marsden, and T. S. Ratiu, Univ. Montreal Press, 1986, pp. 125-208.

“Nonlinear Stability of Kelvin-Stuart Cat’s Eyes Flows for Compressible Fluids,” with J.E. Marsden and T. Ratiu, in *Nonlinear Systems of Partial Differential Equations in Applied Mathematics*, D.D. Holm, J. M. Hyman and B. Nicolaenko, ed., AMS Lect. in Appl. Math., Vol. **23**-Part 2, 1986, pp. 171-186.

“Stability of Rigid Body Motion Using the Energy-Casimir Method,” with J. E. Marsden, T. Ratiu, and A. Weinstein, in *Fluids and Plasmas: Geometry and Dynamics*, J. E. Marsden, ed., *Contemporary Mathematics* **28** (1984) 15-24.

“Stability of Planar Multifluid Plasma Equilibria by Arnold’s Method,” in *Fluids and Plasmas: Geometry and Dynamics*, J. E. Marsden, ed., *Contemporary Mathematics* **28** (1984) 25-50.

“Self-Consistent Theory of Pondermotive Stabilization,” with A. N. Kaufman and P. L. Similon, *Bull. Am. Phys. Soc.* **29** (1984) 1301.

“Action Principle for Self-Consistent Wave-Plasma Interaction,” with A. N. Kaufman, S. Omohundro, and J. Wurtele, *Bull. Am. Phys. Soc.* **29** (1984) 1241.

“Lyapunov Stability Conditions for a Relativistic Multifluid Plasma,” with B. Kupershmidt, in *Proceedings of the 1984 International Conference on Plasma Physics*, Lausanne, Switzerland, Vol. II, p. 214.

“Generalized Poisson Brackets and Nonlinear Liapunov Stability – Application to Reduced MHD,” with R. D. Hazeltine, J. E. Marsden and P. J. Morrison, in *Proceedings of the 1984 International Conference on Plasma Physics*, Lausanne, Switzerland, Vol. II, p. 208.

“Theory of R.F. Stabilization of Axisymmetric Tandem Mirrors,” with A.N. Kaufman and P.L. Similon, in *Proceedings of the 1984 International Conference on Plasma Physics*, Lausanne, Switzerland, Vol. II, p. 185.

“Theory of R.F. Stabilization of Axisymmetric Tandem Mirrors,” with A. N. Kaufman and P. L. Similon, in *Annual Controlled Fusion Theory Conference, Incline Village, Nevada, April 11-13, 1984*, paper 3P14.

“Nonlinear Stability Conditions for a Relativistic Multifluid Plasma,” in *Annual Controlled Fusion Theory Conference, Incline Village, Nevada, April 11-13, 1984*, paper 3P1.

“Fundamental Aspects of Similarity Analysis in Hydrodynamics and Radiation Hydrodynamics,” with R.A. Axford, in *Proceedings of the Joint Los Alamos/Limeil Conference on Hydrodynamics and Instabilities, June 28-July 2, 1982*, 1983, pp. 1-23.

“Gyroscopic Analog for Magnetohydrodynamics,” in *Mathematical Methods in Hydrodynamics and Integrability in Related Dynamical Systems*, M. Tabor and Y. Treve, ed., American Institute of Physics, 1982, pp. 73-84.